User manual

One and four channel video links

CFO First Mile series consist of fibre optic modems which provide a high quality and lossless video transmission for variety of CCTV applications.

CFO160 - 1 ch video link for PTZ camera applications

CFO460 - 4 channel video link for PTZ camera applications

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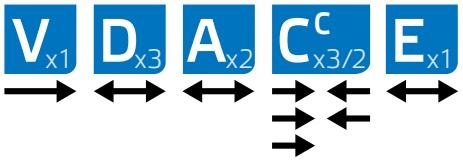
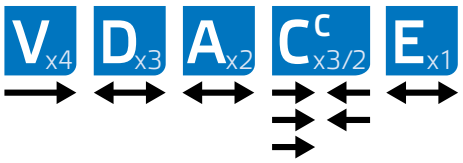
Optical Transmitter & Receiver

One and four channel video link for uni-directional video and bi-directional audio, data, contact closure & Ethernet transmission

CFO160 video link



CFO460 video link



Welcome, and thank you for purchasing Teleste's CFO Products.

Introduction

The **CFO160/460** series is a basic building block for multi-channel video transmission system providing uni-directional transmission of 1 / 4 uncompressed video channels with three bi-directional data, two audio, 3/2 contact closure and one Fast Ethernet signal over optical fibre.

PAL and **NTSC** video formats are supported to provide a transparent video transmission. With **CFO160/460** models it is also possible to transmit three bi-directional RS data channel e.g. for PTZ control. All common data protocols are supported and are easily configurable by DIP switches.

Optical transmission is based on hot-swappable **SFP transceivers** (class 1M). The high speed optics enable a full quality and a zero-delay (latency free) video transmission. Available SFP options are supporting 2 km transmission over multimode fibre or 20/40 km operation over single-mode fibre.

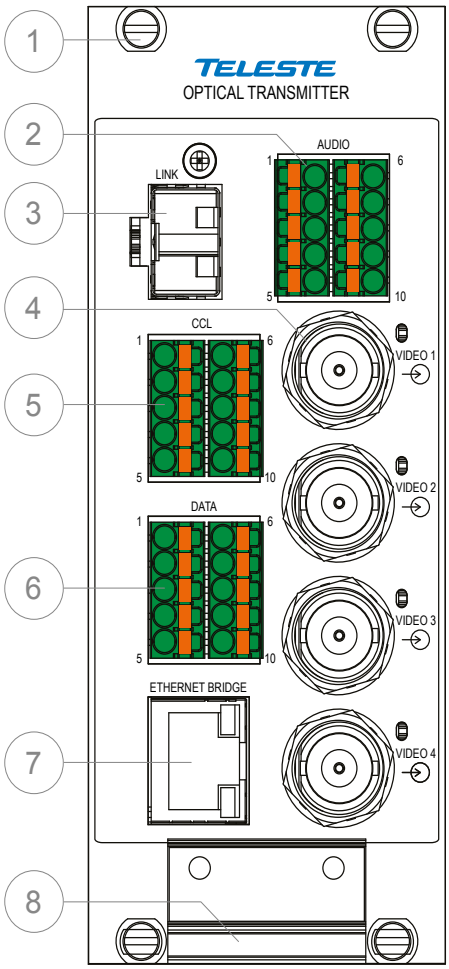
As with all CFO Platform products the units meet all standard EMC and environmental requirements.

All units are fully compatible with all CFO rack systems. Stand-alone options are available with the CMA module adapter and a separate mains adapter.

Features

- 1 and 4 channel video multiplexer
- One and four CVBS (PAL/NTSC) video channels
- Alternative SFP optics for various optical needs
- Standard alternatives 2 km MMF, 20 km SMF and 40 km SMF
- Video SNR 58 dB typical, 8 bit video sampling
- Data supports RS232, RS422 or RS485
- Uncompressed zero delay digital transmission
- Fast Ethernet Bridge, full 100% throughput
- Multiple Contact Closure channels
- Dual Audio
- Common card units for rackmount or stand-alone installations
- Compatible with all CFO installation systems
- EMC and environmental conformance

Video Link Front Panel



An example view for **CRT460** optical transmitter (same information applies respectively to receiver unit **CRR460**).

1) Locking screw (4 pcs)
2) AUDIO connector (push-in terminal block, 5-pin)
3) Slot for SFP optical tranceiver and link status led
4) Video input (BNC female) and video indicator led
5) CCL connector (push-in terminal block, 5-pin)
6) DATA connector (push-in terminal block, 5-pin)
7) ETHERNET BRIDGE connector (RJ-45)
8) Handle (with unit information)

CAUTION:
CFO160/460 OPTICAL UNITS USES CLASS 1M LASER DIODE. DO NOT STARE INTO BEAM OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS. APPLICABLE STANDARD IEC60825-1: 2001

Frame installation

The **CFO** unit is to be pushed along the guide rails into the installation frame (e.g. **CSR216** or **316** series) and secured with the four locking screws. The unit can be freely positioned in any slot in the frame. (Alarm card slot excluded). The empty positions in the frame should be blanked off with cover plates. The supply voltage is to be provided by a **CPS384** or **CPS390** power supply unit.

Video connections and indicator leds

The impedance of the video connection (BNC female) is 75 Ω.
The nominal input/output level is 1 Vpp. Video connection is equipped with the dual colour VIDEO led on the front panel. See table below for explanation of VIDEO indicator led's lights.

Colour	Status
Green	A signal is present and in nominal level
Yellow	No video signal, or the video level is too low

VIDEO indicator operation.

Receiver alarm connection

Alarm at the rear connector of the unit is an open collector output, with the capability of 30 V/10 mA switching (alarm status = low imp.).

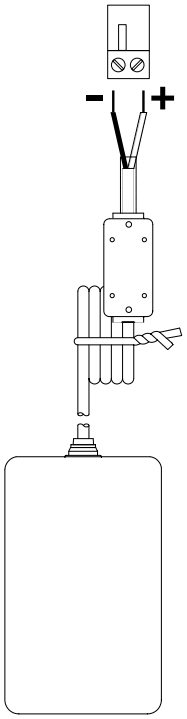
Alarm	Description	Reason
B	Link status alarm	No synchronisation achieved at optical input.

Refer to documentation of CCU001/002 rack alarm cards.

Stand-alone installation

CMA025 module adapter.

CPS251 12VDC Mains adapter.



Power supply connection.

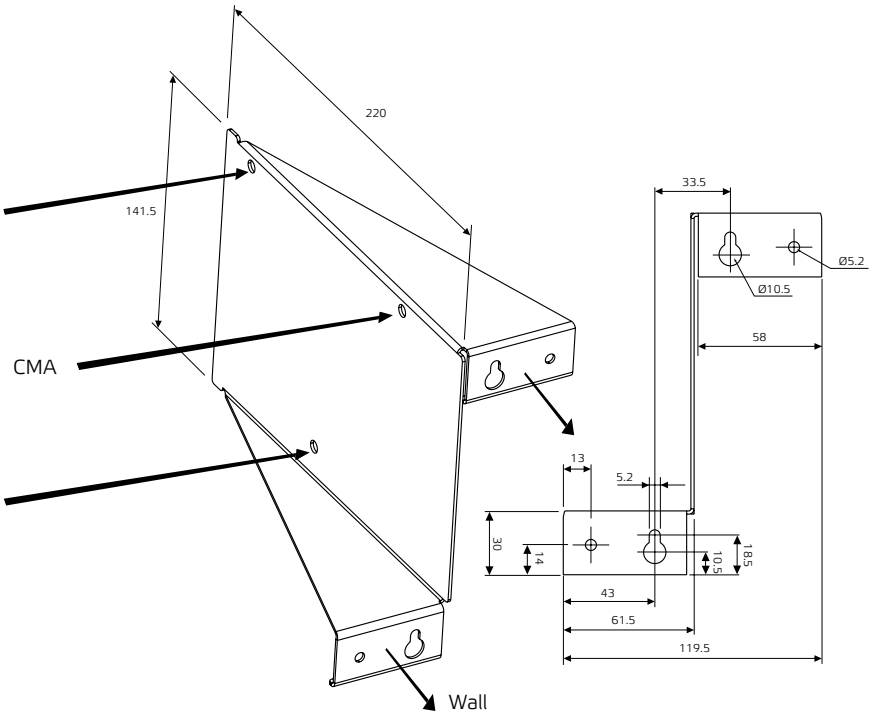
For limited space installation the CMA module adapters can be rear-mounted by means of an optional installation kit CIK002.

CMA025 module adapter with CIK002 rear mounting kit.

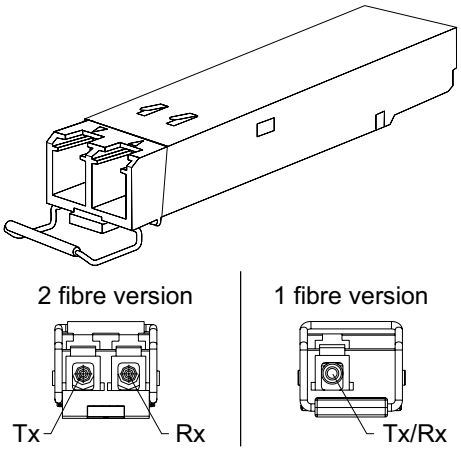
The units can be installed for stand-alone use by using a **CMA025** (installation for 10HP wide CFO series units) module adapters. To insert a CFO card unit into the module adapter, push the unit along the guide rails into module until the unit is firmly attached. Secure the plug-in unit with the upper and lower locking screws.. The stand-alone unit should be mounted to a vertical surface.

The 12V DC supply voltage is supplied by the means of a separate mains adapter with a regulated output, (e.g. **CPS251**). *Please refer to separate documention for module adapters and mains adapters.*

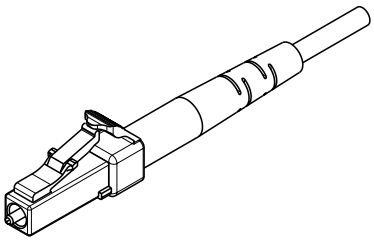
By using an optional mounting kit (item code CIK002) a rear side mounting is enabled (below CIK002 rear mounting kit dimensions).



Optical Interface



SFP optical transceiver module.



Optical connector is type LC/PC.

Optical connection meets class 1M laser safety requirements of IEC 60825-1: 2001 and US department of health services 21 CFR 1040.10 and 1040.11 (1990) when operated within the specified temperature, power supply and duty cycle ranges.

Link indicator led

The status of optical link is indicated by a led next to the SFP slot.

Colour	Status
Green	Optical signal level is adequate and syncronization on link level is achieved
Yellow	Optical signal is missing or input level is too low

LINK indicator operation. ***Note!*** *On unidirectional links (CFO160) the led at the transmitter module is always green.*

Fibre connection

The optical interface is a small form-factor pluggable (**SFP**)**,** see picture beside. The optics is hot-swappable. Optical cable connector in use is type **LC/PC**. The optical operation depends on the type of selected SFP transceiver module. This information is marked to the model's type sticker which is located on the side of the unit.

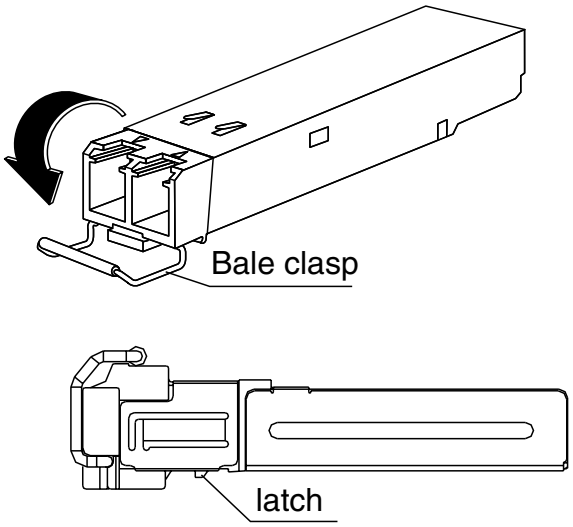
When installing the fibre optic cable, do not exceed the minimum bending radius when connecting cable to the system.

Note! *For correct optical operation and to ensure quality connections between fiber optic devices it is important that every fiber connector be inspected and cleaned prior to mating. Connectors should always be cleaned with professional cleaning equipment and accessories for fibre optics. The optical connectors on the equipment should always be protected with dustcaps when there is no fibre inserted.*

Any contamination in the fibre connection can cause failure of the component or failure of the whole system. Even microscopic dust particles can cause a variety of problems for optical connections. A particle that partially or completely blocks the core generates strong back reflections, which can cause instability in the laser system. Dust particles trapped between two fibre faces can scratch the glass surfaces. Even if a particle is only situated on the cladding or the edge of the endface, it can cause an air gap or misalignment between the fibre cores which significantly degrades the optical signal.

SFP transceiver module

If your transmission requirements change, simply unplug the existing SFP module, and plug-in the new module. Keep the protective dust plugs on the unplugged fibre-optic cable connectors and the transceiver optical bores until you are ready to make a connection. Save the dust plugs for future use. Be sure to clean the optic surfaces of the fiber cable before you plug the cable into another module. When using 2 fibre version SFP, check the order of the Tx/Rx ports.



SFP module's locking release points.

To plug-in and unplug the SFP module, follow these steps

Remember to use personal grounding device to prevent ESD occurrences when installing SFP module.

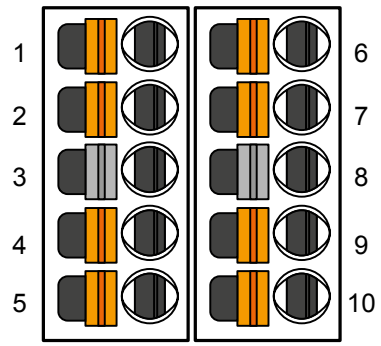
To plug-in the module:

1. Do not remove the optical bore dust plugs. Open the bale clasp on the SFP module by pressing the clasp downward until it is in a horizontal position. Then insert the SFP into the socket by pressing the SFP into the slot firmly with your thumb until you feel the connector latch into place.
2. Verify that the SFP is seated and latched properly by trying to remove it without releasing the latch. If the SFP can not be removed, it is installed and seated properly. If the SFP can be removed, reinsert it and press harder with your thumb, repeating if necessary until it is latched securely into the socket.

To unplug the module:

1. Disconnect the network fibre optic cable from the SFP transceiver module connector (immediately reinstall the dust plugs in the SFP transceiver module's optical bores and the fiber-optic cable LC connectors).
2. Pull the out and down to eject the SFP transceiver module from the socket connector. If the bail clasp latch is obstructed and you cannot use your index finger to open it, use a small, flat-blade screwdriver or other long, narrow instrument to open the bail clasp latch. Grasp the SFP transceiver module between your thumb and index finger, and carefully remove it from the socket. Place the removed SFP transceiver module in an antistatic bag or other protective environment.

Configuring Audio Channels



AUDIO connector.

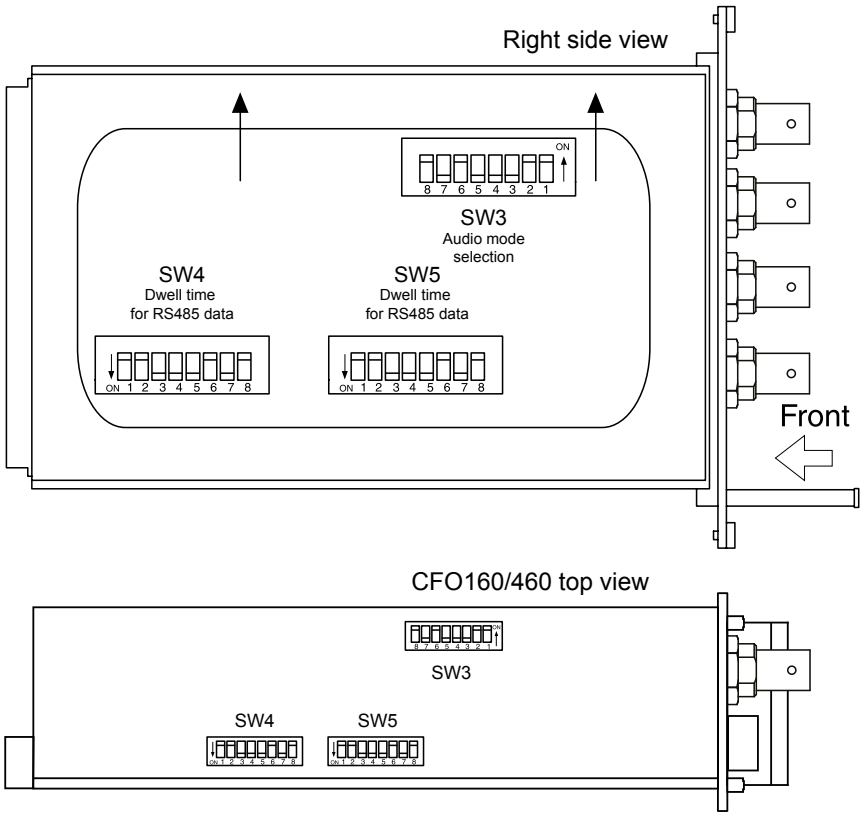
Pin	Balanced signal	Unbalanced signal
1	Audio 1 in -	
2	Audio 1 in +	Audio 1 in
3	GND	GND
4	Audio 1 out -	
5	Audio 1 out +	Audio 1 out
6	Audio 2 in -	
7	Audio 2 in +	Audio 2 in
8	GND	GND
9	Audio 2 out -	
10	Audio 2 out +	Audio 2 out

AUDIO connector's pinout.

Audio Connection

The **CFO160/460** link contains two bi-directional audio channels (TX <--> RX), which can be used for one stereo audio or two mono audio purposes. The AUDIO interface supports both balanced (both channels separately) and unbalanced wiring. **The default audio input impedance is set to high impedance (>10 kΩ)**. (this setting requires balanced connection for both channels).
Alternatively the audio input impedance can be set to 600 Ω.
The audio output impedance is set to 10 Ω. The connector type is a push-in terminal block. The audio channels operates independently, i.e. despite the absence of all video signals.

The desired audio connection mode is selected by DIP switches (SW3).

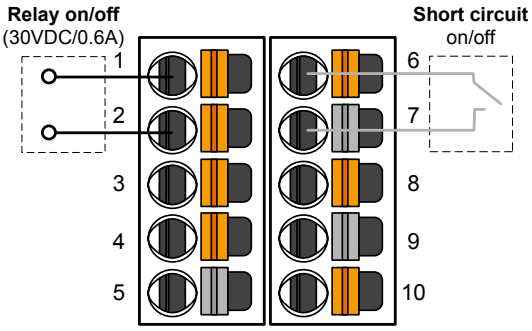


DIP swithes are located on the top of device.

SW3 DIP switch position								
Audio	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1 balanced	on	off	off					
1 balanced input 600 Ω	on	off	on					
1 unbalanced	off	on	off					
2 balanced				on	off	off		
2 balanced input 600 Ω				on	off	on		
2 unbalanced				off	on	off		

Audio 1 and Audio 2 connection settings (SW3).

Configuring Contact Closure Channels



CCL connector.

Contact closure loop (CCL) connection

The link provides three contact closure channels in direction of TX to RX, and two contact closure channels in direction of RX to TX. The CCL input is a normal short circuit on/off (dry contact) - signal between connector's contact pins. The CCL output is a normal relay on/off - signal between connector's contact pins as shown in the table below (maximum switching 30V / 0.6A). The connector type is a push-in terminal block.

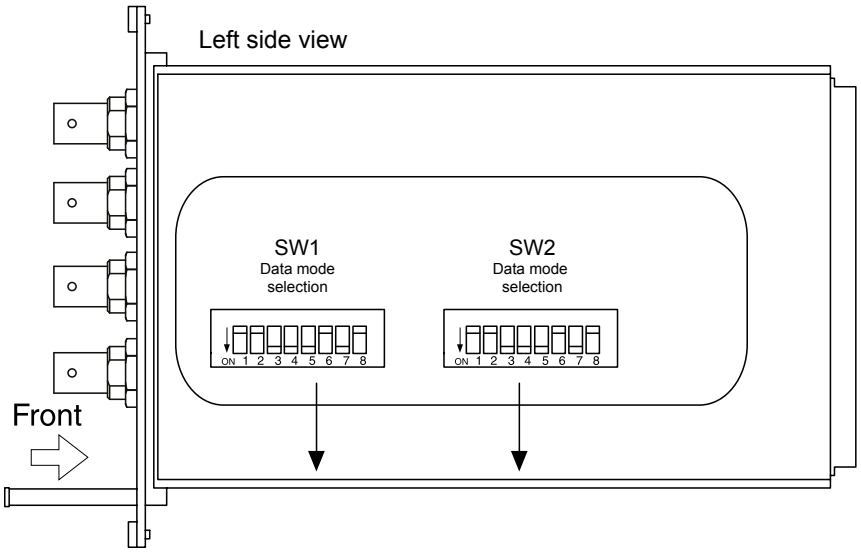
Pin	TX (3 x CC in, 2 x CC out)		RX (2 x CC in, 3 x CC out)	
1	CC1 out	VSA	CC1 out	VSA
2	CC1 out		CC1 out	
3	CC2 out	LSA	CC2 out	LSA
4	CC2 out		CC2 out	
5	GND		CC3 out	
6	CC1 in		CC1 in	
7	GND		GND	
8	CC2 in		CC2 in	
9	GND		GND	
10	CC3 in		CC3 out	

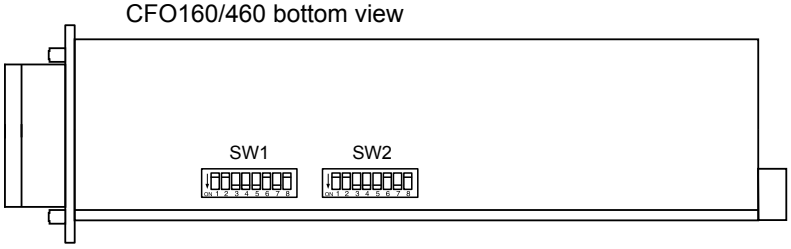
CCL connector's pinout.

***Note!** Enabling **VSA** on channel 1 overrides normal contact closure functionality.*

***Note!** Enabling **LSA** overrides normal contact closure and VSA functionality.*

The CCL output channel can be alternatively configured for VSA (video source alarm) or LSA (link source alarm) usage. The desired contact closure (outputs 1 and 2) connection must be confirm by the means of (SW1) DIP switches.





DIP swithes are located on the bottom of device.

Configuring VSA and LSA alarms

SW1 DIP switch position									
Data 2 type	**1**	**2**	**3**	**4**	**5**	**VSA/LSA**	**6**	**7**	**8**
RS232	off	off	off	off	off	VSA	on		
RS422				off	off	LSA		on	
RS485-2w				on	on				
RS485-4w				off	off				
- line bias		on	on						
- no line bias		off	off						
- termination	on								
- no term.	off								

VSA/LSA settings (SW1).

Video Source Alarm (VSA)

The **CCL output** channel can be alternatively configured for Video Source Alarm (**VSA**) monitoring. Instead of normal CCL use, the CCL output can be used to provide a VSA signal if a loss of video signal occurs.
When VSA mode is enabled at **transmitter** and if video signal is missing (e.g. a camera malfunction, link otherwise operates normally), the CCL output pins are closed. Using VSA at just one end of the link enables the opposite path to be used for standard CCL operation (simplex). In case when VSA is enabled both at **transmitter** and **receiver**, the CCL channel is no longer available for any other use. When VSA is disabled the CCL channel is available for normal use in both directions. The VSA mode can be set on/off via management connection.

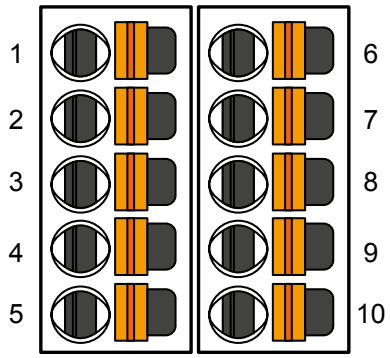
Note! *Enabling VSA on any channel overrides normal contact closure functionality.*

Link Source Alarm (LSA)

The **CCL output** channel can be alternatively configured for Link Source Alarm (**LSA**) monitoring. Instead of normal CCL use, the CCL output can be used to provide a LSA signal if a loss of optic link occurs. When LSA mode is enabled at transmitter and if optical communication is disturbed seriously (link fail alarm due to e.g. a cable break or damage, a laser fail etc), the CCL output pins are closed. Using LSA at just one end of the link enables the opposite path to be used for standard CCL operation (simplex). In case when LSA is enabled both at **transmitter** and **receiver**, the CCL channel is no longer available for any other use. When LSA is disabled the CCL channel is available for normal use in both directions.
For a practical use the LSA/CCL operation can be also used to control an optical switch in fibre redundant applications.

Note! *Enabling LSA overrides normal contact closure and VSA functionality.*

Configuring Data Channels



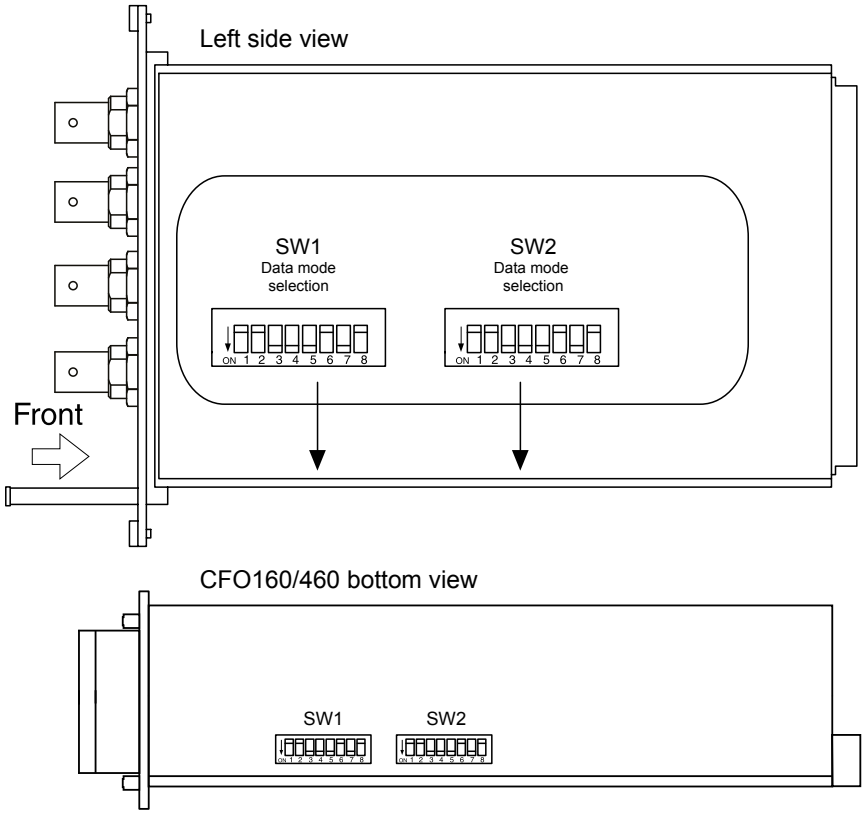
DATA connector.

Data connection

The **CFO160/460** link provides three independent bi-directional data channels (CRT <--> CRR). The connector type is a push-in terminal block. Available data modes for data channel 1 and 2 are **RS232**, **RS422**, **RS485-2w** and **RS485-4w**. Data channel 3 is fixed for **RS232** mode only.
See table below how to connect the desired data type. The desired data mode settings can be set by the means of DIP switches. **The default factory setting is RS232.**

Pin	Signal	RS232	RS422	RS485-2w	RS485-4w
1	Data 1		in -	in / out -	in -
2		in	in +	in / out +	in +
3		out	out -		out -
4			out +		out +
5	Data 3	in			
6	Data 2		in -	in / out -	in -
7		in	in +	in / out +	in +
8		out	out -		out -
9			out +		out +
10	Data 3	out			

Data connector's pinout and supported data types.



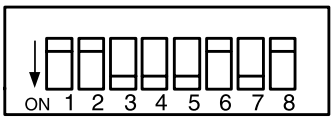
DIP switches for connection type settings are located on the bottom of device.

SW1 DIP switch position									
Data 2 type	**1**	**2**	**3**	**4**	**5**	**VSA/LSA**	**6**	**7**	**8**
RS232	off	off	off	off	off	VSA	on		
RS422				off	off	LSA		on	
RS485-2w				on	on				
RS485-4w				off	off				
- line bias		on	on						
- no line bias		off	off						
- termination	on								
- no term.	off								

Data 2 connection settings (SW1).

SW2 DIP switch position									
Data 1 type	**1**	**2**	**3**	**4**	**5**	**Ethernet**	**6**	**7**	**8**
RS232	off	off	off	off	off	Autoneg			off
RS422				off	off	100/FD	off	off	on
RS485-2w				on	on	100/HD	off	on	on
RS485-4w				off	off	10/FD	on	off	on
- line bias		on	on			10/HD	on	on	on
- no line bias		off	off						
- termination	on								
- no term.	off								

Data 1 connection settings (SW2).

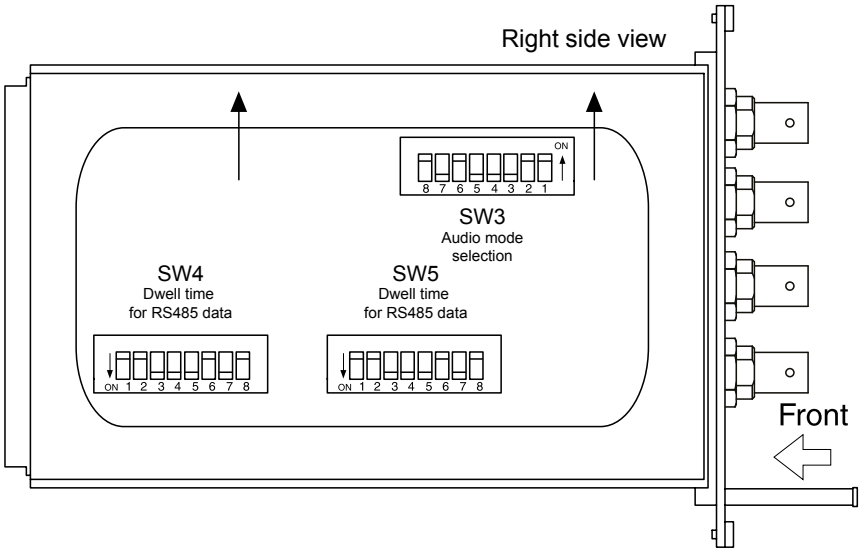


CRR160/460 DIP switches (SW1 and SW2) for data mode selection.

Data mode settings (Receiver CRR160/460)

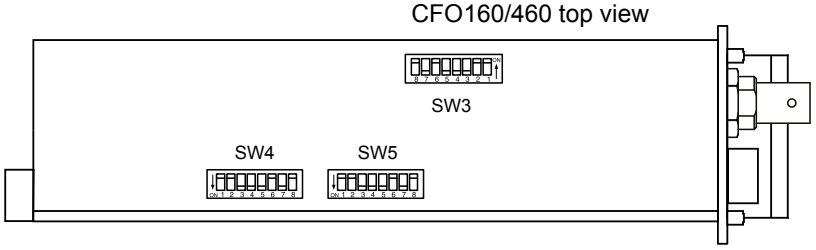
The desired data mode settings including dwelltime settings for **RS485-2w** can be set by the means of DIP switches. **The default factory setting is RS485-2w + dwelltime 75 µs, no line bias and no term.**

Note! *These settings are done only at the video receiver.*



CRR160/460 DIP switches are located on the top of device.

CFO160/460 top view



CRR160/460 DIP switches are located on the top of device.

SW4 (Data 1) and SW5 (Data 2) DIP switch position									
Dwell time settings for RS485-2w data					Tx data		Rx data		Data channel mode
Dwelltime ms	1	2	3	4	5	6	7	8	
0,01	on	on	on	on	on	on	on	on	RS232
0,02	off	on	on	on	off	off	off	off	RS422
0,04	on	off	on	on	on	off	on	off	RS485-2w
0,075	off	off	on	on	off	off	off	off	RS485-4w
0,1	on	on	off	on					
0,2	off	on	off	on					
0,4	on	off	off	on					
0,6	off	off	off	on					
1	on	on	on	off					
1,2	off	on	on	off					
2	on	off	on	off					
3	off	off	on	off					
4	on	on	off	off					
6	off	on	off	off					
8	on	off	off	off					
10	off	off	off	off					

Data mode selection and RS485-2w dwelltime settings (Data 1, SW4 and Data 2, SW5).

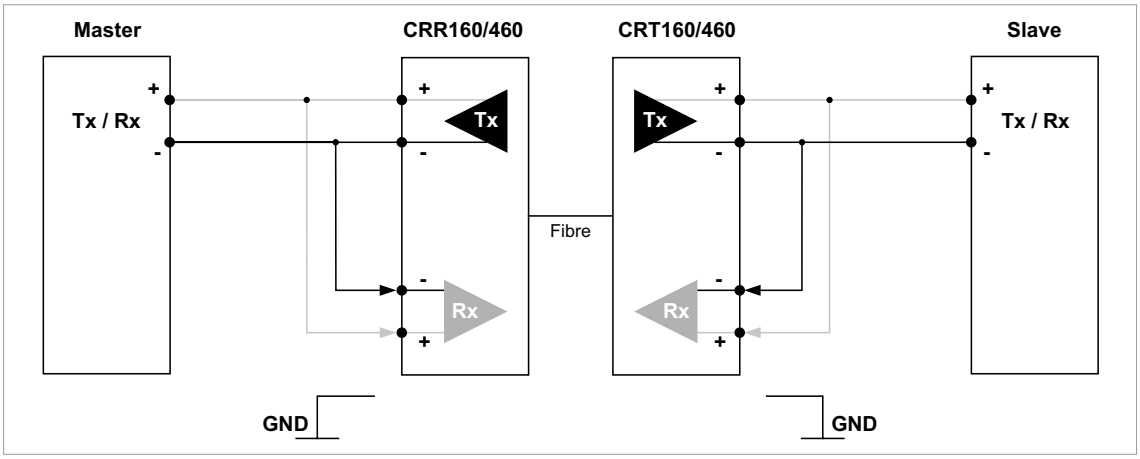
Note! *The data mode is only selected in the receiver.*

Data formats

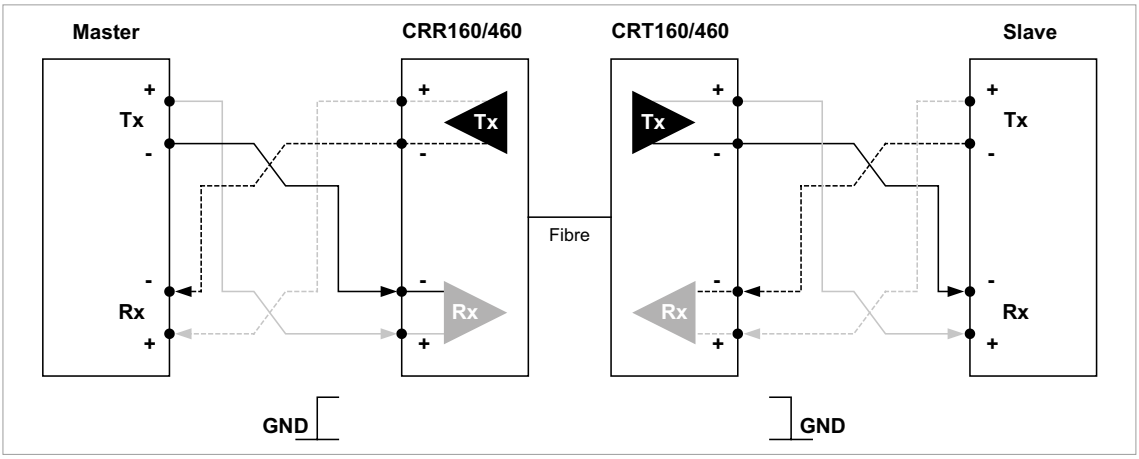
RS232 is an unbalanced data format (i.e. the signal wire working against a reference – ground). Simplex RS232 requires two connections (signal and ground). Full-duplex RS232 requires three connections (signal TX, signal RX and ground).

RS422 is a balanced data format. Simplex RS422 requires three data connections (+/- and ground). Full-duplex RS422 requires five data connections (in+/in-, out+/out- and ground).

RS485 is used for full-multipoint communications where multiple transceiver devices may be connected to a single twisted-pair signal cable. Most RS485 systems use a Master/Slave architecture, where each Slave unit has a unique address and responds only to packets addressed to that unit. Packets are generated by the Master (e.g. CCTV controller keyboard), which periodically 'polls' all connected Slave units (e.g. CCTV camera receiver units). The Slave unit that has been addressed then sends the appropriate reply packet back to the Master. Slave units have no means of initiating communication without the risk of a collision so they need to be assigned the 'right to transmit' by the Master (by polling). RS485 exists in two versions, 2-wire and 4-wire.



RS485-2w data connection diagram.
A 2-wire RS485 network is implemented as a half-duplex system using single twisted-pair cabling. This means that data can flow in both directions but only in one direction at a time. As the fibre links not synchronised with master/slave devices trasmit - receive turn-time (aka dwelltime) needs to be manually selected. See the table on left for selectable predefined turn-time values.

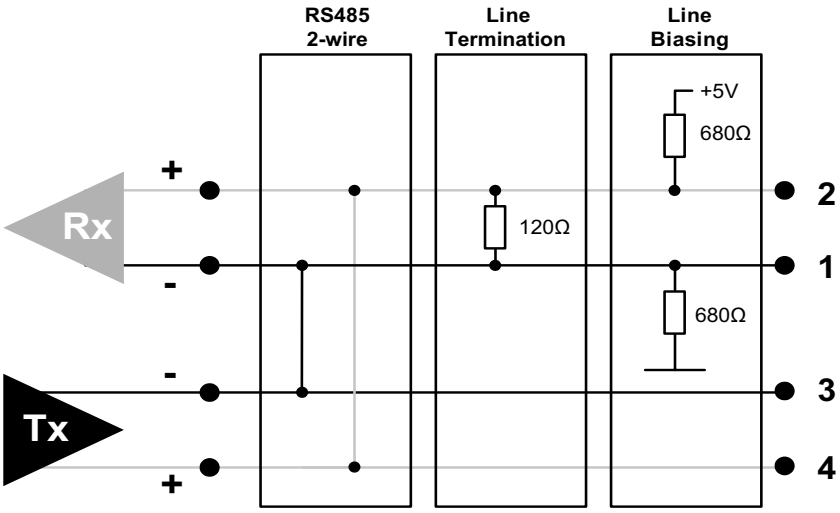


RS422 / RS485-4w data connection diagram.
A 4-wire RS485 network can be implemented as a full-duplex system using two twisted-pair buses where each bus is used for each direction of transmission. In full-duplex mode the turn-time value is ignored.

Data termination and biasing

Termination is used to match impedance of a node to the impedance of the transmission line being used. When impedance are mismatched, the transmitted signal is not completely absorbed by the load and a portion is reflected back into the transmission line. If the source, transmission line and load impedance are equal these reflections are eliminated.

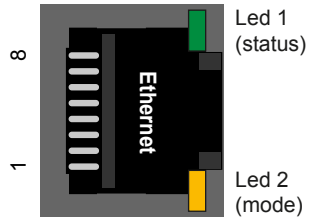
Biasing -> the lines will be biased to known voltages and nodes will not interpret the noise from undriven lines as actual data; without biasing resistors, the data lines float in such a way that electrical noise sensitivity is greatest when all device stations are silent or unpowered.



Data mode	Input termination options
RS232	None
RS422	No term (with failsafe) Line termination (120 Ω)
RS485 - 2w	No term (with failsafe) Line bias (forced 680 Ω line biasing) Line termination (120 Ω)
RS485 - 4w	No term (with failsafe) Line bias (forced 680 Ω line biasing) Line termination (120 Ω)

Data input termination options for data channels. Data termination connects 120 Ω between pins. Hard line bias connects 680 Ω (+input) to +5V and GND (- input).

Ethernet Interface



ETHERNET BRIDGE connector.

Pin	Signal
1	Tx + / Rx +
2	Tx - / Rx -
3	Rx + / Tx +
4	
5	
6	Rx - / Tx -
7	
8	

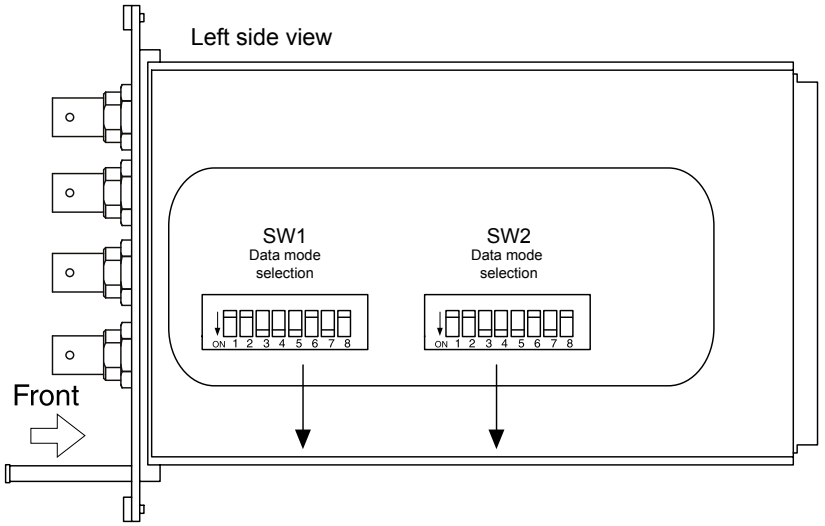
Ethernet Bridge connector's pinout.

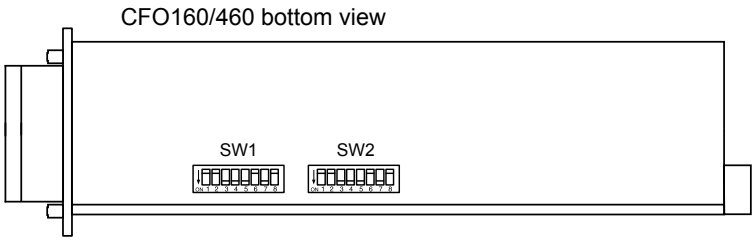
Ethernet Bridge Connection

The ETHERNET BRIDGE interface provides one Ethernet 10/100Base-Tx port for any IP device requiring Ethernet connectivity. The connector type is a RJ-45 female. At 100Mbps operation the supported throughput is 100% with all standard frame sizes. Default port configuration is with autonegotion feature enabled.

Led	Colour	Status
1	Green	Link up
	Green blinking	Link active and traffic detected
	No light	Link down or disabled
2	Yellow	Full Duplex
	Yellow blinking	Collisions
	No light	Half Duplex

Ethernet bridge interface's indicator operation.





DIP swithes are located on the bottom of device.

SW2 DIP switch position									
Data 1 type	**1**	**2**	**3**	**4**	**5**	**Ethernet**	**6**	**7**	**8**
RS232	off	off	off	off	off	Autoneg			off
RS422				off	off	100/FD	off	off	on
RS485-2w				on	on	100/HD	off	on	on
RS485-4w				off	off	10/FD	on	off	on
- line bias		on	on			10/HD	on	on	on
- no line bias		off	off						
- termination	on								
- no term.	off								

Ethernet connection settings (SW2).

Technical Specifications

Optical		
SFP plug-in optics	see block diagram examples	
2 km multimode	1310 & 1310 nm	bidi 2-fibre, model S
20 km singlemode	1310/1550 nm	bidi 1-fibre, model M
40 km singlemode	1310/1550 nm	bidi 1-fibre, model L
Connector	Single or duplex-LC/PC	

Video		
Number of channels	1, composite video	CFO160
	4, composite video	CFO460
Sampling frequency	13.88 MHz	
Sampling resolution	8 bits	
Source and load impedance	75 ohm	
Input and output signal levels	1 Vp-p	
Input overload level	1.5 Vp-p	DC component
Insertion gain	+/- 5%	
Bandwidth	5.8 MHz	-3 dB
C/L gain inequality	+/-5%	
C/L delay inequality	40 ns	
Differential gain	2%	
Differential phase	1º	
S/N ratio	58 dB typical, unified weighted ITU-T J.61	
Connector	BNC female	

Data		
Number of channels	3 bi-directional	
Data format		
RS232	bi-state, 2-wire, EIA RS232C	
RS422	bi-state, 4-wire, EIA RS422	
RS485-2W	tri-state, 2-wire half-duplex, EIA RS485	
RS485-4W	tri-state, 4-wire, EIA RS485	
Data termination		
485/422 specific	Line termination	selectable
	Line bias	selectable
	Half-duplex dwell-time	selectable
Data rate	0...230 kbps	
Sampling rate	16 MHz	oversampled
Connector	push-in terminal block	

Audio		
Number of channels	2 bi-directional	unbalanced / balanced
Sampling frequency	81.4 kHz	
Sampling resolution	16 bits	
Input impedance	600/10k ohm	selectable
Output impedance	10 ohm	
Nominal level	0 dBm	
Clipping level	+20 dBm	
Frequency response	0.02...20 kHz	- 3 dB, ref. 1 kHz
S/N ratio	70 dBqp	CCIR weighted

Contact Closure		
Number of channels	3/2	bi-directional
Input	dry contact	open/close, max loop R 120 ohm
Output	relay	max 30 V/1A switching
Data rate	5 Hz	max

Ethernet Bridge		
Number of ports	1	bi-directional
Port type	10/100Base-TX	configurable
Compliant	IEEE802.3, IEEE802.3U	

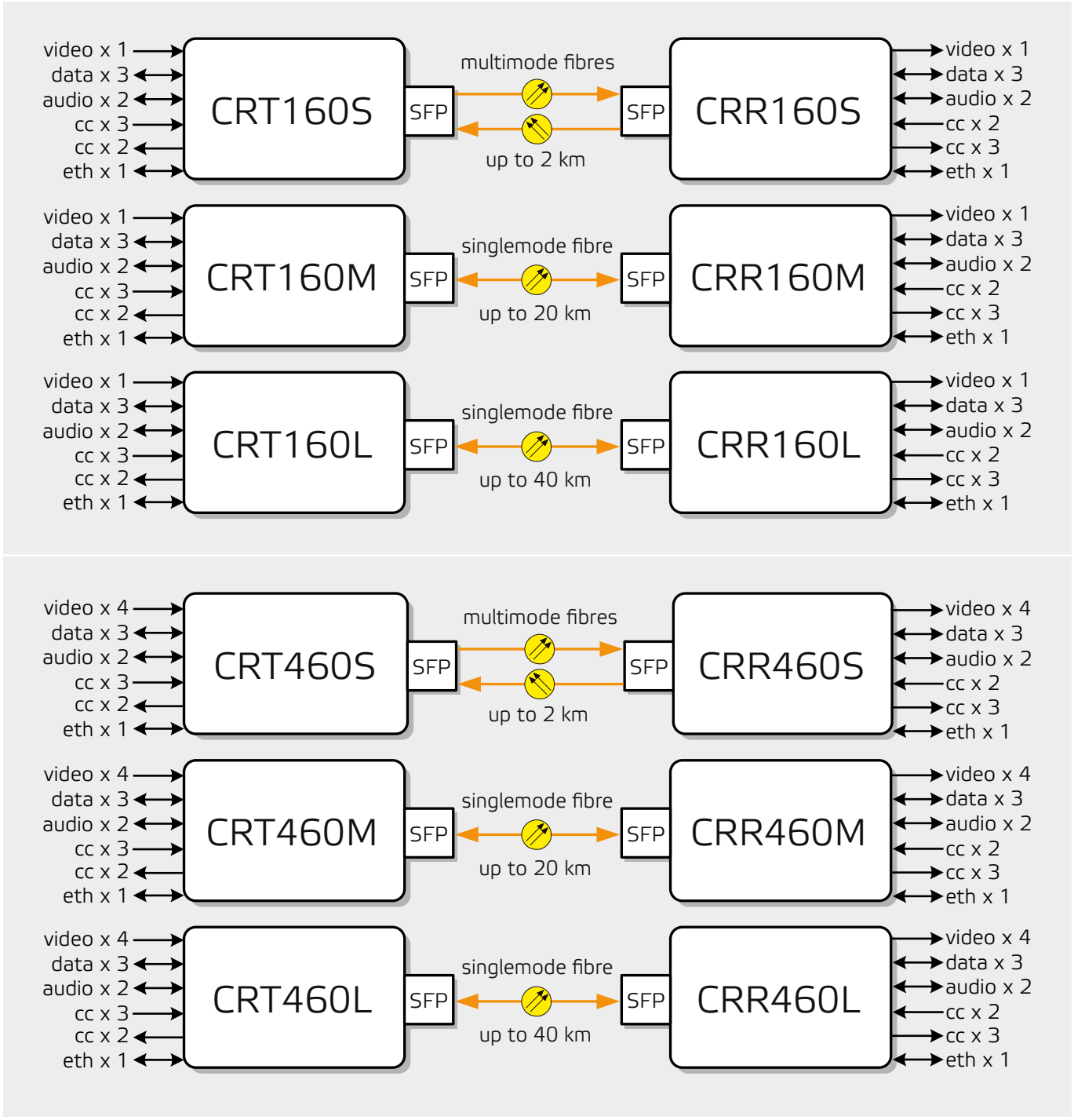
General		
Supply voltage	10.5...14 VDC	regulated
Current consumption, max	450 mA	operational with SFP
Dimensions	3U x 10HP x 190 mm	
Weight	0.5 kg	
IP Housing	20	dry indoor required
Operating temperature	-34...+74 ºC	
Storage temperature	-40...+80 ºC	
Humidity	0...90%	non-condensing
Indicators LEDs	Video presence, Link status, Ethernet bridge	
Alarm	Link status	B-alarm (open collector)
	Video source	B-alarm (open collector)
EMC conformance	EN61000-6-3, EN50130-4	
Optical conformance	EN 60825-1, FDA 21 CFR 1040.21 and 1040.11	
Safety	EN 60951-1	
Other	RoHS	

Notes

Class 1M Laser product

Typical values unless otherwise stated

Block Diagrams



Notes

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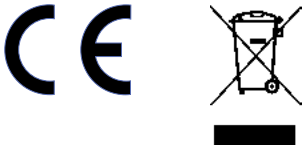

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